ELECTRICAL PROTECTION WHEN USING PORTABLE AC OPERATED TOOLS AND EQUIPMENT

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1. GENERAL

1.01 This section contains information on the safe work practices to be followed when using ac operated tools and equipment. This practice also applies to the ac operated equipment or test gear.

1.02 This section is reissued to:

- Include information that was previously contained in Section 080-120-101.
- Include identical information in Section 620-103-010.
- Update illustrations to conform with the revised National Electrical Code.
- Provide information on double-insulated tools and ground fault interrupter units.
- Require tools equipped with 3-conductor cords be tested for ground continuity upon receipt, after maintenance, and at monthly intervals.

Since this is a general revision, arrows ordinarily used to indicate changes have been omitted.

1.03 The operator of portable electric equipment is protected from electric shock by:

(a) Providing a continuous effective low resistance ground return to the power system from the device equipped with a 3-conductor cord.

(b) Using a double insulated Underwriters Laboratories (UL) approved tool.

Note: Tools operated from ungrounded portable electric generators (circuit isolated from ground) do not require grounding. The grounded type 3-wire type receptacle has been provided to accommodate the connection of various portable tools to the generator.

1.04 Grounding as described in this section is accomplished by a third conductor in the cord that is used to connect the tool housing to the local power grounding system or to other equivalent grounds such as a continuous metallic cold water pipe which is covered by a minimum of 10 feet of earth.

1.05 Grounding the metal framework on portable electric tools protects the operator from electrical shock caused by insulation breakdown of current carrying parts within the housing. Grounding prevents a hazardous voltage on the metal framework of the tool.

1.06 Bell System approved soldering coppers used in central offices and PBXs and approved double insulated power tools do not require grounding. All other portable power tools equipped with a metal housing and not designated "double insulated" shall be effectively grounded. (Tools operated by ungrounded portable generators do not require grounding.)

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If grounding cannot be accomplished as outlined in this section, the electric tool must not be operated. Nonelectric tools should be used to complete the job.

1.07 Additional electric shock protection is provided on aerial lift, electrified vehicles, and power trailers, by equipping the 120 volt, 15 and 20 ampere grounding type 3-wire interrupter. (See Part 6.)

1.08 In wet locations, a ground fault interrupter may be used in lieu of running a grounding cord to a suitable ground.

2. PRECAUTIONS

2.01 Use only electric equipment, cords and adapters provided or approved by the Bell System.

2.02 Check that proper grounding connections are made and will not become disengaged during operation.

2.03 Do not connect to receptacles of unknown configuration or voltage.

2.04 Check to ensure that the cordage between the electrical outlet and power tool and any grounding wires are placed and protected so they will not interfere with the movement of, or create a hazard to, the public or employees.

2.05 Electric power tools shall not be operated while the user is standing in water.

2.06 Never use electric tools or lamps having damaged or worn cords, damaged plugs, defective switches, or other defective parts that might give the user an electric shock.

2.07 All power tools and equipment shall be removed from service immediately when found defective. They shall be tagged ***DEFECTIVE*** if the defect is not corrected when found.

2.08 Replacement cords shall have equal or larger gauge wire than original. Extension cords shall be used only in continuous lengths without splices.

2.09 When repairing or replacing stranded power conductors, it is advisable to twist the strands together and tin with solder before securing at screw terminals. This action will minimize fraying and possible shorting.

2.10 All 3-conductor cords assembled or repaired locally, including those serviced by outside agencies, shall be tested for ground continuity before connected to a power supply.

2.11 Test the ground conductor with a buzzer or ohmmeter for continuity from the case of the tool to the grounding blade of the plug. Test the other conductors for lack of continuity from the case of the tool to the other blades. These tests should be performed with the "ON-OFF" switch in both positions.

All applicable tests outlined in 2.10 and 2.11 shall be performed upon initial receipt of a tool, after any maintenance, and at monthly intervals.

3. PROVISIONS FOR GROUNDING

3.01 All electric power tools requiring grounding as covered in 1.04 should be equipped with a 3-conductor cord which terminates in a standard 3-blade plug (Fig. 1).

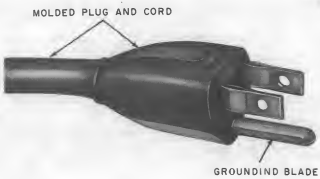

Fig. 1—Standard 3-Blade Plug

3.02 The adapter shown in Fig. 2 is used at a grounded convenience outlet to extend the power service ground for a 3-conductor device.

3.03 The grounding terminal of the adapter (Fig. 2) has a green-colored rigid tab (ear, leg, or similar device) which must be turned to the center of the convenience outlet and secured

Fig. 2—Adapter

to the grounded, uninsulated, metal face plate. The pigtail, wire type, adapters are now considered obsolete but may remain in service until there is cause for replacement with the updated model.

Note: When using a Hubbell BL12433 (Fig. 3) adapter with a 2-conductor ungrounded receptacle, a ground screw is provided for the external ground termination.

Fig. 3—Hubble BL-12433 Adapter

3.04 When it is not possible to obtain a ground source at the convenience outlet, either the B (Fig. 4) or C (Fig. 5) grounding cords or a length of grounding wire (14-gauge) may be used.

(a) The B grounding cord (Fig. 4) is a 15-foot, 18-gauge, single-conductor cord with clips at both ends.

(b) The C grounding cord (Fig. 5) is identical to the B cord except that it has a clip on one end and a 3-conductor plug adapter on the other end.

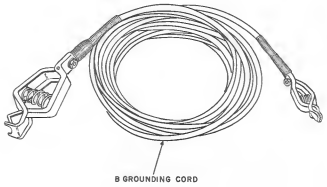

Fig. 4—B Grounding Cord

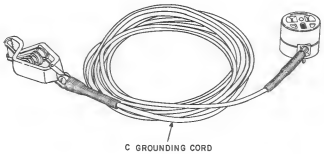

Fig. 5—C Grounding Cord

3.05 C and D extension cords shown in Fig. 6 are available for connecting power tools to outlet receptables remotely located from the work area. These cords, 30 feet in length, have a standard molded male plug at one end and a standard molded female connector body at the other. The C extension cord is wired with 18-gauge conductors while the D cord uses 14-gauge conductors.

Fig. 6—Extension Cord

3.06 The D extension cord is used for connecting heavy duty electric tools such as a 1/2-inch drill or an electric soldering pot to a power outlet. The D extension cord is rated for 15 amperes at 120 volts or 1.875 kW. The C extension cord is rated at 7.5 amperes at 120 volts or 937 watts. Figure 7 gives a typical cord makeup using an extension cord and adapter.

Warning: Do not connect an electrical device in a C or D extension cord if its rated load exceeds that of the cord.

4. METHOD OF GROUNDING

4.01 ***Three-Wire Grounding Type Receptacles:*** The most satisfactory method of providing an effective ground is through the connection of a 3-blade plug to a compatible 3-wire receptacle (Fig. 8).

4.02 ***Two-Wire Receptacles—Ungrounded Outlet Box:*** Where electrical connections are to be made at ungrounded 2-wire parallel receptacles, proceed as follows:

(a) Locate a nearby grounded object, which has a continuity to the electric service ground, such as a continuous cold water pipe, faucets, radiators, metallic power conduit, etc, a grounding cord may be attached.

Caution: Do not use an isolated metallic object or ground rod which is not bonded to the electric power service ground.

(b) Extend and attach the grounding cord (Fig. 9) to the grounded object, making certain that a good solid metallic connection is made on both ends.

4.03 ***Two-Wire Receptacles—Grounded Outlet Box:*** Where a building is wired with metallic conduit, armored cable, or nonmetallic sheath cables with a grounding conductor, the outlet boxes should be grounded. When it is known that the outlet is grounded, an approved, properly placed adapter (Fig. 10) shall be used to extend the ground medium to the electrical device.

5. DOUBLE INSULATED TOOLS

5.01 Protection from electrical shock when using a tool equipped with a 3-conductor cord is dependent upon the metallic case being effectively grounded by means of the green wire in the power cord.

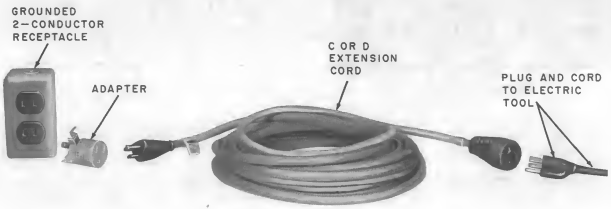

Fig. 7—Typical Cord Makeup

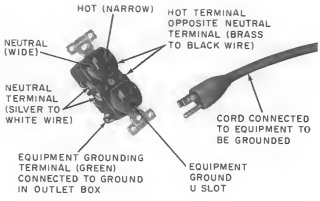
HOT (NARROW)
HOT TERMINAL OPPOSITE NEUTRAL TERMINAL (BRASS TO BLACK WIRE)
NEUTRAL (WIDE)
NEUTRAL TERMINAL (SILVER TO WHITE WIRE)
CORD CONNECTED TO EQUIPMENT TO BE GROUNDED
EQUIPMENT GROUNDING TERMINAL (GREEN) CONNECTED TO GROUND IN OUTLET BOX
EQUIPMENT GROUND U SLOT

Fig. 8—Wiring of 125V Standard Plug and Receptacle

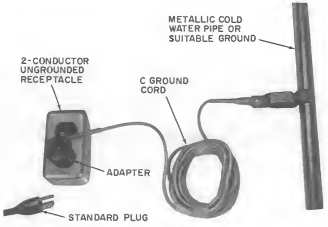

Fig. 9—Ungrounded Outlet Box

5.02 Double insulated tools provide reliable shock protection without the third wire ground in the form of reinforced insulation. In addition to the functional insulation, a reinforced or protective insulation is incorporated into the tool. The extra or reinforced insulation is physically separated from the functional and is arranged so that deteriorating influences such as wear, temperature, and contaminants will not affect both insulations at the same time. Double insulation does not take the place of normal safety precautions employed when operating electrical tools. The added insulation only protects the user from injury resulting from internal electrical failure.

5.03 A double insulated tool does not require a separate ground wire connection. Double

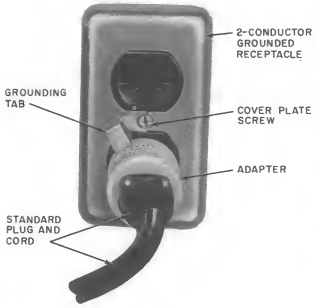

Fig. 10—Grounded 2-Conductor Receptacle

insulated tools can be identified by the words "double insulated" stamped on the tool. If the tool does not have the identification, it must be grounded in accordance with Parts 3 and 4 of this practice.

6. GROUND FAULT INTERRUPTER

6.01 ***Definition:*** A ground fault interrupter is a device which acts to interrupt the electrical circuit when leakage current to ground exceeds a predetermined and safe value (about 5 milliamperes). This value is considerably less than that required to operate the conventional over current devices, such as fuses and circuit breakers.

6.02 All "electrified" aerial lift vehicles and power trailers shall have the 120 volt single phase, 15 and 20 ampere convenience outlets protected with ground fault interrupters. A ground fault interrupter is a supplement to grounded 3-wire systems and double insulated tools, not a substitute.

6.03 If the ground fault interrupter trips, proceed as follows:

(1) Remove tool(s) from receptacle.

(2) Reset the circuit breaker. (If the breaker will not reset, the trouble is internal and a qualified technician should be consulted.)

(3) If the breaker resets, the tool (or cord) is faulty and should be taken out of service. Other tools may be used to complete the job.

6.04 Older plugs with fiber face discs often absorb sufficient moisture during wet weather to cause leakage between the blades that will be corrected by substituting a molded plug for the older plug.